

Landslide Prone Areas:

Oregon proposed to address this element of the additional management measures for forestry condition through a mix of regulatory and voluntary approaches. While the State has adopted more protective forestry rules to reduce landslide risks to life and property and promotes some voluntary practices to reduce landslide risks through the Oregon Plan for Salmon and Watersheds (The Oregon Plan), it still does not have additional management measures for forestry in place to protect high risk landslide areas to ensure that water quality standards and designated uses are achieved.

Since January 13, 1998, Oregon has amended the Oregon FPA rules to require the identification of landslide hazard areas in timber harvesting plans and road construction (OAR 629-623-0000 through 629-623-0800). However, under these amendments, shallow, rapidly moving landslide hazards directly related to forest practices are addressed only as they relate to risks for losses of life and property, not for potential water quality impacts. Oregon still allows harvest of high-risk sites that will not cause a public safety risk and construction of roads on high-risk sites where alternatives are not available.

As noted in the January 13, 1998, findings, timber harvests on unstable, steep terrain can result in increases in landslide rates which contribute to water quality impairments. A number of studies continue to show significant increases in landslide rates after clear-cutting compared to unmanaged forests in the Pacific Northwest.

For example, in the 2000 study, "Forest Clearing and Regional Landsliding," Montgomery et. al., concluded that landslide rates in Mettman Ridge in the Oregon Coast Range increased after clear cutting at a rate of three to nine times the background rate for the region. The regional analysis from this study found that forest clearing dramatically accelerates shallow landsliding in steep terrain typical of

the Pacific Northwest.

Decades of quantitative measurement indicate that roots can mechanically reinforce shallow soils in forested landscapes. In a 2001 paper considering the role of root cohesion in landslide susceptibility, Schmidt et. al found that median lateral root cohesion ranges from 6.8–23.2 kPa in industrial forests with significant understory and deciduous vegetation to 25.6–94.3 kPa in natural forests dominated by coniferous vegetation. In clearcuts Schmidt et. al report that lateral root cohesion is uniformly less than or equal to 10 kPa, making these areas much more susceptible to landslide¹.

Forest canopies also affect the stability of natural slopes. Forest canopies can modify the intensity of precipitation, such that their presence may prevent sliding in some instances. In a 2003 paper, Keim and Skaugset² investigated the effects of forest canopies on slope stability. Their modeling resulted in estimates of slope stability that were generally greater under forest canopy than for the same hillslope without forest canopy.

In its July 1, 2013, submittal Oregon also cites a limited study by Turner et al. (2010), indicating that at higher rainfall intensities, significantly higher landslide densities occurred on steep slopes compared to lower gradient slopes. Turner et al. (2010) also found that at higher rainfall intensities, the density of landslides in recently harvested sites was roughly 2-3 times the landslide density in older stands.

To meet the additional management measure relating to high-risk landslide prone areas, the State must adopt similar harvest and road construction restrictions for all high-risk landslide prone areas with the potential to impact water quality and designated uses, not just those areas where landslides pose risks to life and property.

¹ <http://eps.berkeley.edu/~bill/papers/104.pdf>

² <http://onlinelibrary.wiley.com/doi/10.1002/hyp.5121/pdf>

The State employs a voluntary measure under the Oregon Plan that gives landowners credit for leaving standing live trees along landslide prone areas as a source of large wood. The large wood, which may eventually be deposited into stream channels, contributes to stream complexity, a key limiting factor for coastal coho salmon recovery.

However, while Oregon has professed a desire to better capture and evaluate the implementation and effectiveness of voluntary measures,

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ensure implementation of this measure. These are required elements if a state chooses to use voluntary programs to support its coastal nonpoint program (see the federal agencies' 1998 Final Administrative Changes guidance).

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Comment [KT1]: Could mention that these results are generally consistent with other landslide studies in the NW (Ketcheson and Froehlich, 1978; Robison et al., 1999).

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